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A BRAIN TUMOR LOCALIZED AND COMPLETELY REMOVED, WITH SOME DISCUSSION OF THE SYMPTOMATOLOGY OF LESIONS VARIOUSLY DISTRIBUTED IN THE PARIETAL LOBE.[1]

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The rapidity with which the symptoms indicating serious cerebral disease developed; the presence of a well-defined symptom-complex showing a lesion situated at the junction of the parietal and occipital lobes, and the complete success which resulted from surgical interference, mark the case which is the basis of this paper as one of the most instructive that has yet appeared in the literature of cerebral localization and intracranial surgery. For the opportunity of seeing the case, we are indebted to Dr. H. A. Spangler, of Carlisle, Pa., who before it was seen in consultation, had recognized the nature and probable location of the disease from which the patient was suffering. We shall first present the clinical history of the case, including a résumé of the operation with comments, and shall then briefly discuss its bearings upon the subject of the focal diagnosis of lesions, especially tumors variously distributed in the parietal lobe.

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[1] Read at the thirty-fourth annual meeting of the American Neurological Association, May 20, 21 and 22, 1908.

The patient was a married woman, forty-five years old, who had enjoyed average good health until October, 1907, although two to three years before she had had several attacks of what she described as dizziness or lightness in the head. She had not however suffered with headache, nausea or vomiting. She went to Philadelphia on October 26, 1907, and while there had an attack which she regarded as a bilious spell, and in which she suffered from dizziness, nausea, and vomiting, but no headache. About a week later she had a severe attack of vertigo or dizziness, in which she did not fall or lose consciousness. One week after this she had another attack of dizziness, with a little headache, but without nausea and vomiting. She also at this time showed a little forgetfulness of some details in packing her trunk.

During the few days following she did not feel very well, occasionally being a little dizzy and having headache. On Saturday, November 30, while in Philadelphia she was in fairly good health, but on her way home the next day she was very sick at her stomach and suffered much from headache and dizziness in the cars. She reached home feeling very badly.

On November 30 she almost ran into a tree, and later into a post. These objects were on her left. On the same and the following day she failed to notice persons passing her on her left.

After her return to Carlisle, Dr. Spangler discovered the existence of something wrong with her sight, and with her nervous system and at his suggestion she went to Philadelphia to see Dr. G. E. de Schweinitz, whom she first saw December 19, 1907. The report of Dr. de Schweinitz, made at about this time, showed the presence of left lateral homonymous hemianopsia, and beginning optic neuritis. The fields are shown in Fig. 1.

She returned to Carlisle, where she continued under the treatment of Dr. Spangler, and where she was seen by Dr. Mills in consultation December 30. In the meantime, during the month of December, before she was seen by Dr. Mills, she had headache, worse at times, and was occasionally dizzy. About this time and later she had every two or three days attacks of nausea and vomiting, with dizziness and headache. During the night she would suffer with headache, and in the morning would be sick at her stomach and vomit, with some dizziness, the headache continuing but abating somewhat at noon and returning again in the night. She began to drag the left leg a little, and did not use the left hand and arm as skilfully as the right, this impairment and awkwardness varying considerably at different times. Ever since her first symptoms were noticed in October, the patient had had a peculiar puffing sound in the left ear, and a singing or buzzing sound in the right, although her hearing had not changed. Her memory and powers of attention continued good.

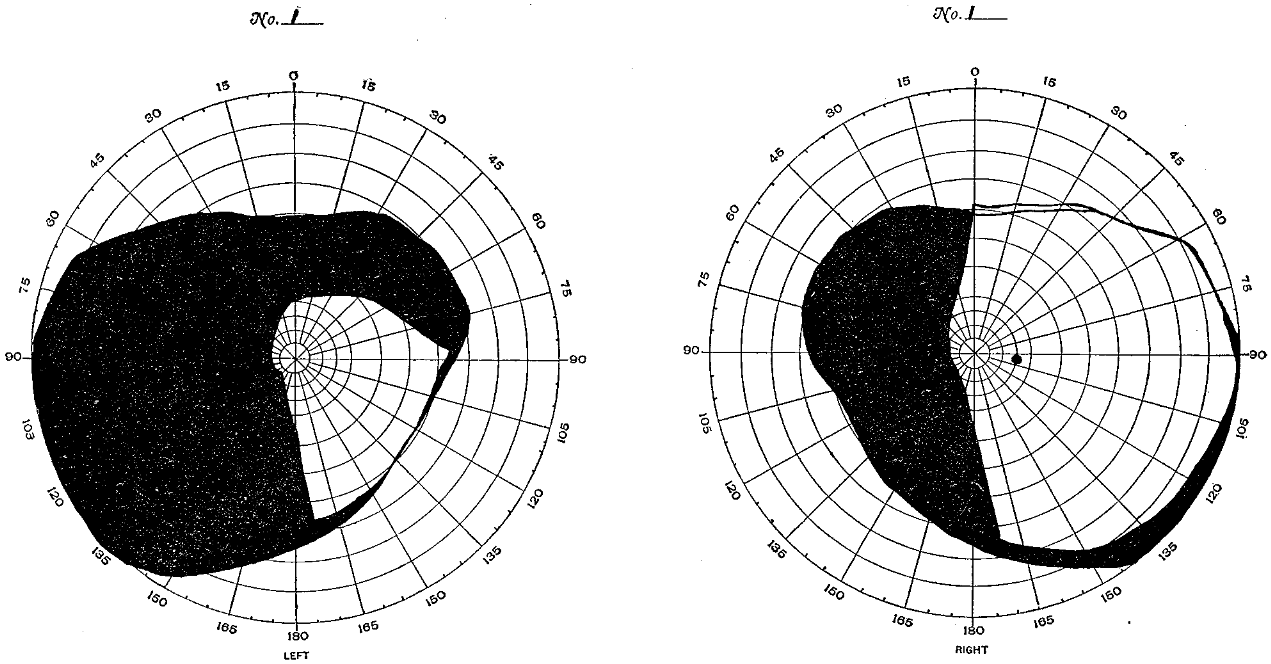

FIG. 1. Diagram showing visual field, December 19, 1907. Hemianopsia absolute; color correctly seen within prescribed fields. Vision, right eye, 6/7.5; left eye, 6/6.

On December 30, when the patient was examined by Dr. Mills in conference with Dr. Spangler, at Carlisle, the chief cerebral symptoms presented were left lateral homonymous hemianopsia; quite moderate hypesthesia of the left extremities; hypastereognosis on the same side as tested in her hand, some ataxia with atactic tremor of the left upper extremity; impairment of the ability to use her left leg and arm, this being due to incoordination rather than to loss of strength. Central vision was little if at all affected; she had no word deafness or word blindness; no aphasia, sensory, motor, or mixed. Her reflexes were not abnormal, or only slightly so, the Babinski response being absent and the response to plantar stimulation being slight or not present.

The patient continued at her home under the care of her family physician from December 30 until February 1. From time to time reports regarding her were made by Dr. Spangler, these showing a very gradual increase in the symptoms indicating the cerebral lesion. Examinations made of her urine during this time showed no albumin and only a few hyaline casts. During this period Dr. J. Walter Park, of Harrisburg, made three separate reports regarding her eyes, each revealing about the same condition, except that the last one showed some increase in the optic neuritis. The ophthalmic findings of Dr. Park summarized were as follows: Vision in the right eye was 20/30 and in the left 20/15; she read number 4 minion type with right eye and number 2 pearl with the left eye. Her field of vision of each eye showed a hemianopsia of the nasal side of the right eye and of the temporal side of the left eye. The ophthalmoscope showed considerable optic neuritis; the veins were tortuous and full, sometimes disappearing under the edematous retina, and then reappearing. At Dr. Park's second examination he found two fatty or albuminoid spots, three or four mm. in size, showing in the right eye, one slightly below, and the other above the disc. They had no well-defined edges, were flame-like in appearance, and fairly whitish.

During January she was under treatment with iodide and bromide in moderate doses. This treatment had indeed been tried previously, but her stomach did not stand it well and she made no improvement under its use.

After a conference by letter it was decided to bring the patient to Philadelphia, where she came February 1, and was at once admitted to the University Hospital. An examination made soon after her arrival showed the same conditions as were present on December 30, with some additions. The dominating symptoms were still the left hemianopsia and hemiataxia. The results of the examination in detail were as follows:

The patient's left palpebral fissure was wider than the right. The left pupil was slightly larger than the right. Both were round. Associated upward movement seemed to be limited, but was not lost. There was no paralysis or weakness of the individual superior muscles of either eye. Lateral movements seemed to be well performed. Downward movements, both individual and associated, were well performed. Convergence movement was very slight on the first test, but after several attempts the movement improved. Nystagmus was absent. The pupils responded to light stimulation and to convergence.

The brow was wrinkled equally well on each side. The right eye was forcibly closed better than the left. Resistance to opening was greater on the right than on the left. Slight flattening of the left nasolabial fold was present, with a drooping of the angle of the mouth on that side. The teeth were displayed a little better on the right than on the left side, and puckering the lips for whistling was better done on the right than on the left. Expression of emotion, as in laughing, was equal on the two sides. Voluntary movement of the right side of the face was better than that of the left. The mouth opened straight, no deflection, as in fifth nerve paralysis, occurring. Power was well retained in the masseters and temporals.

In the left upper extremity resistance to passive movements, as compared with the right, was possibly somewhat impaired, and the patient showed a little awkwardness in some of the finer movements.

Light hypesthesia was uncertainly shown on the left, as compared with the right. As the patient herself expressed it, the difference was trifling, and she sometimes seemed to be uncertain about it. She had slight hypastereognosis on the left, at least this was the conclusion from the tests. She recognized everything, but with a little less readiness on the left than on the right. She had some loss of the sense of position and of movement on the left. If movements were made of parts of the limb on the left side, she could not repeat the same on the right side; but if the movements were made on the right side, she could repeat them on the left. The sense of location was undoubtedly better on the right than on the left. Again and again she failed to recognize the place where the finger was touched on the left, whereas when tested on the right she quickly indicated the position. She had very distinct ataxia in the finger to nose test on the left side, hovering and uncertainty being easily observed, although not pronounced. No ataxia was shown when the test was made with the right forefinger. The grip on each side was good, somewhat better on the right, but it must be remembered that the patient was right-handed.

She had no Romberg symptom. She had some awkwardness of gait, due to the impairment of muscular sense in the left lower extremity.

No Babinski was present on either side. Slight plantar flexion was shown on plantar stimulation on the left, and the same on the right. The knee jerks were prompt on both sides, probably a little more so on the right. Ankle clonus was absent.

Ophthalmic examinations were made on several occasions by Dr. G. E. de Schweinitz. He reported on February 3, 1908:

"The optic neuritis of the right eye is now five diopters in height, an increase of two and one-half diopters since the nineteenth of January. The optic neuritis of the left eye, which was just beginning, is now three diopters in height, an increase of fully two diopters. An entirely new process is the development of numerous hemorrhages, which have appeared thickly on the swollen discs and in the neighboring retinal areas, and give the impression of being the result of thrombi in the retinal veins, or, in other words, thrombotic hemorrhages, although it is perfectly possible that some of them, owing to the difficulty of venous return, are the representatives of a true diapedesis. Both processes are the common etiological factors in this type of hemorrhage, I think. There is absolute left lateral hemianopsia, that is to say, the blind fields are blind for form-sense, color-sense, and light-sense (Fig. 2). This may be of some importance in your localization. Wernicke's symptom is not present; in point of fact, if there is any difference in the reaction of the pupil to the changes of light and shade, the light reaction is a little more active when the light falls upon the blind side of the retina,—certainly there is no difference. There has been marked failure of direct visual acuity, which has fallen from practically normal to 6/12, or one-half, on the right side, and to 6/7.5 on the left side, that is to say, a little better than two-thirds."

The effects of the operation (to be hereafter described) on the hemianopsia and optic neuritis, as shown by examinations made by Dr. de Schweinitz at intervals after the operation, were very interesting.

On February 13 he reported as follows:

"I examined your patient this afternoon, and have to report to you that while the hemianopsia continues, there is a distinct gain, and the blind area has lessened in size (Fig. 3). Moreover, the contraction of the preserved fields, which was present when I took the fields of vision on the nineteenth of December and the first of February, has disappeared, so that the preserved halves are now fully normal in extent. This would seem to me a very favorable sign as indicating that the pressure, on the one hand, has not been severe enough to entirely destroy the optic radiations, and that we may have fair hopes that there will be still further gain, and on the other hand, that the intracranial pressure has been so materially lessened that the preserved halves have enlarged. There is no change in the size of the discs, which are still swollen five diopters. There is one large fresh hemorrhage in the right retina, in addition to those which I have previously described. It should be remembered, however, that in many of these cases, not only as we have seen them but as they have been reported elsewhere, the real subsidence of the neuritis did

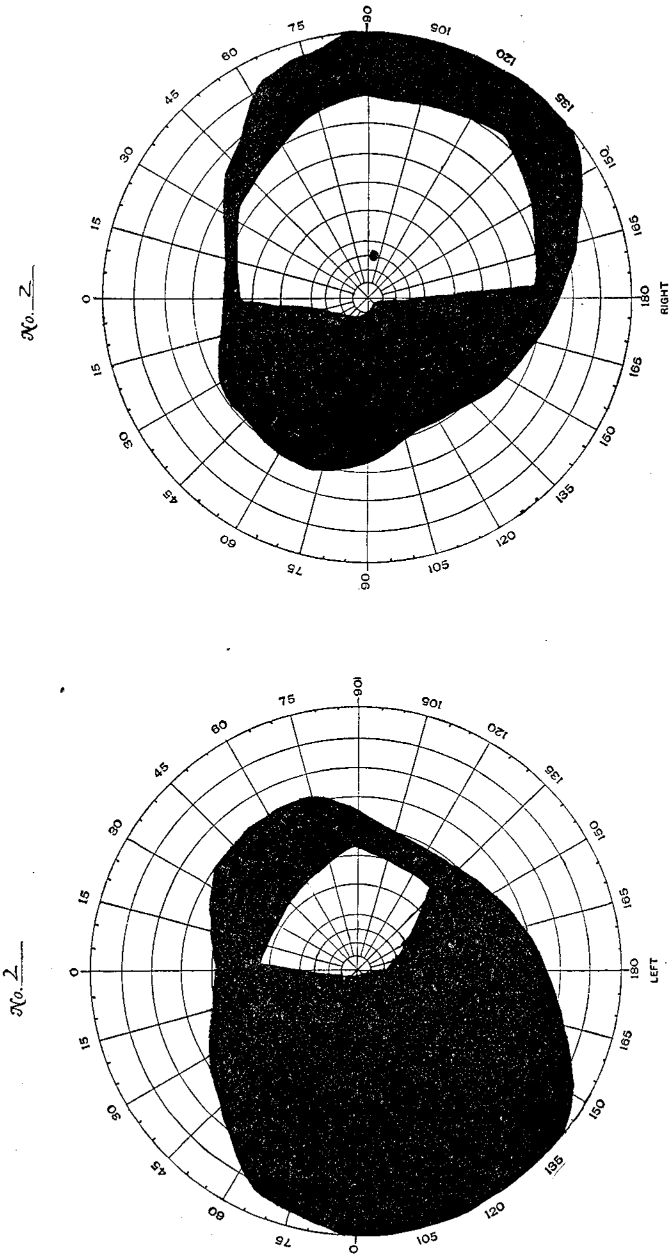

FIG. 2. Diagram showing visual fields, February 1, 1908. Vision, right eye, 6/12; left eye, 6/7.5.

not begin until the fourteenth day, and if I mistake not, in some of Paton's cases as much as five and six weeks elapsed before there was marked lessening of the neuritis."

On March 9 the report was as follows:

"I have great pleasure in reporting to you that the letter vision is normal in each eye, that there is almost complete disappearance of the optic neuritis, each disc being now swollen not more than one diopter. The margins are beginning to appear quite clearly on the temporal sides. In the right eye they have disappeared. While there are still homonymous losses of the visual fields upon the left sides, there has also been a gain in this respect, particularly of the left eye, which now in some meridians is not far from the normal boundaries."

On May 8 Dr. de Schweinitz further reported as follows:

"I examined your patient yesterday, and found the conditions the same as when I reported to you last—practically full field on the right side, with partial hemianopsia upon the left, central vision sharply normal, no hemorrhages of any kind in the retina, and only a very slight haziness of the nasal margins of the disc to suggest the former choked disc" (Fig. 4).

The operation was performed by Dr. Charles H. Frazier on February 5.

SURGICAL MEMORANDUM.

The technique and method of procedure differs in no respect from the routine which we have adopted in the clinic of the University Hospital. The following is a brief description of the operation: Under nitrous oxide ether anesthesia preceded by the administration of one-sixth of a grain of morphine and one hundredth of a grain of atropine the patient was placed upon the operating chair in the erect posture. The incision was made so as to expose portions of the occipital, parietal and temporal lobes. The flap was so fashioned that its base was directed towards the temporal region, the superior margin being one inch from the median line, the anterior margin one and a half inches anterior and the posterior margin two inches posterior to the parieto-occipital fissure. The bone was sectioned with the spiral osteotome and the osteoplastic flap reflected. As soon as the dural flap was reflected the brain at once bulged considerably through the opening, thus assuring us that there was a decided increase of intracranial pressure, the cause for which we at once began to investigate. Upon palpating the exposed surface of the brain an area was discovered in the superior posterior angle of the opening, which, compared with the normal brain structure, seemed much softer if not cystic. It was noted furthermore that in the same region the surface was of a different color. The region thus described did not exceed that of a twenty-five-cent piece and its margins were so sharply defined that it was not difficult to differ-

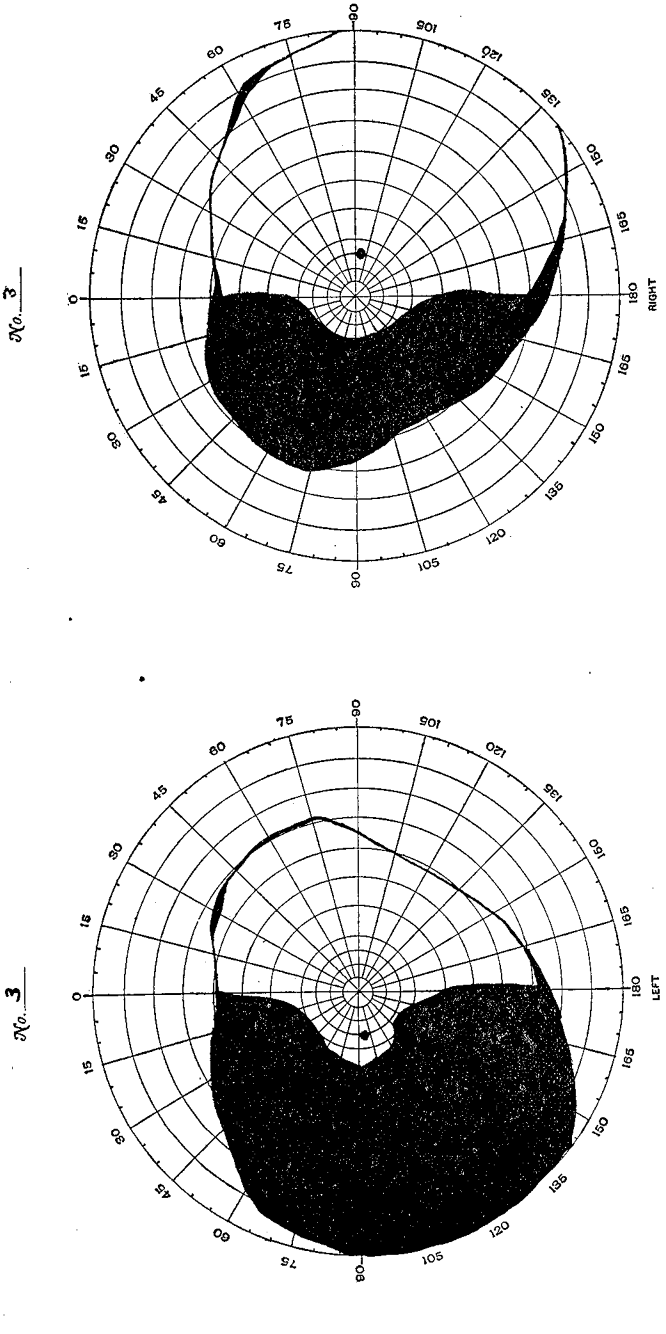

FIG. 3. Visual fields on the eighth day after operation, showing distinct gain; preserved halves are fully normal.

entiate the normal from the abnormal brain tissue. The line of demarcation was much more distinct after the pia mater had been peeled off. With the handle of the scalpel the line of cleavage between the tumor and surrounding structure was easily found, and we at once proceeded to enucleate. While thus engaged there was a sudden spurt of clear straw color fluid and the tumor was now found to be a cyst collapsed. One finger was inserted into the cavity of the cyst as a guide and with but little bleeding the entire cyst wall was removed intact. During this process there was a progressive fall of blood pressure and the table was lowered, changing the position of the patient from the vertical to the horizontal posture. A small rubber tube was introduced into the residual cavity in order to prevent the retention of blood and a possible cyst formation. The dural wound was closed with interrupted silk and the scalp with silk-worm gut sutures. A small groove was cut in the skull just to the median side of the superior margin of the flap and an opening in the scalp made to provide a means of exit for the drainage tube.

From the time the operation began until the bone flap was reflected six or seven minutes had elapsed; within ten minutes the dural flap had been reflected; five minutes more were occupied in determining the seat and margins of the lesion and fifteen minutes for enucleating it. Thus with the exception of closing the wound in the dura and scalp the operation was completed in thirty minutes.

The condition of the patient at no time gave us any cause for apprehension. By the time she had been taken to her room she had recovered consciousness sufficiently to recognize her physician and answer questions intelligently. Her excellent condition at the conclusion of the operation was due in part to the short duration of the operation, to the avoidance of exposure, and to the skill and care with which the anesthetic was administered. In Fig. 5 is shown a photograph of the patient taken four days after operation, showing the size and position of flap. It is needless to call attention to the fact that disregard to certain precautionary measures will have a deleterious effect upon the patient and may lead to a fatal issue. The advantage of conducting the operation expeditiously in a reasonably short time need not be dwelt upon, nor need we emphasize the importance of conserving body temperature, by having the patient warmly clad and last but not least of entrusting the ether always to a trained skilled anesthetist.

The operation was perfomed at a single sitting. We have never been advocates of the two step operation, so popular with some surgeons abroad because experience has shown that the actual removal of a brain tumor has little if any harmful influence, as indicated by the pulse or blood pressure. With this case the question of postponing the removal of the cyst to a

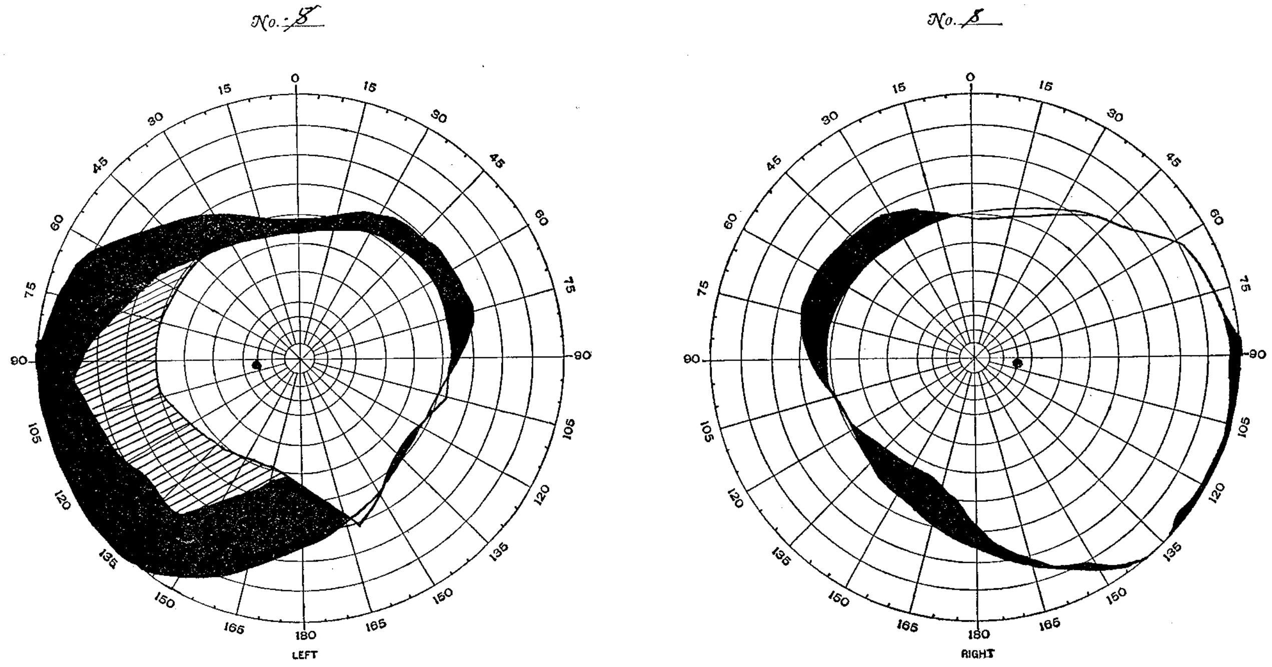

FIG. 4. Visual fields, May 7, 1908. Practically full field on the right side with partial hemianopsia on the left; cross-hatching shows dim vision; central vision sharply normal, right eye, 6/6; left eye, 6/5.

second sitting was not considered. The additional risk of a second anesthetization and of infection must be reckoned with in the two-step procedure. To be sure there are exceptional instances, particularly in cerebellar lesions, in which by the time the lesion has been discovered the condition of the patient may be such as to make it advisable not to proceed.

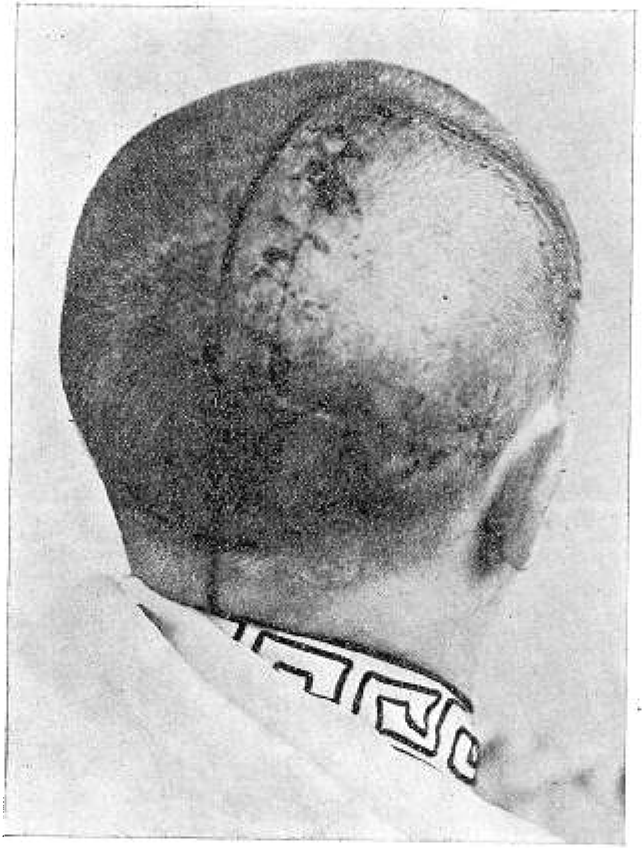

Fig. 5. Photograph of patient taken four days after operation, showing size and position of flap.

The cyst, when filled with fluid, measured eight centimeters in length and four in diameter (Fig. 6.) Its shape was not unlike that of an egg and the greater portion of it was subcortical. Fortunately a small portion of it, what might be said to be one pole, presented on the surface; otherwise it might have escaped detection. While the cyst appeared in the surface in the superior portion of the occipital lobe the greater portion of it extended into the parietal lobe, thus accounting not only for the visual disturbances but for the hemiataxia.

The report from the Laboratory of Surgical Pathology describes the cyst as follows:

The specimen consists of a thin-walled cyst measuring about 8 x 4 cm. in size. When received in the laboratory it contained a ragged rent along one of the surfaces. The outer surface was smooth, even, and of a pinkish-gray color, with a few very small vessels ramifying over the surface. The wall was generally about one or two mm. in thickness and very friable; the interior was smooth except at three places where some soft tissue was adherent to the wall, but could be peeled from the same with ease. This tissue was of a darker color than the wall. When received there was no fluid in the sac, and scrapings from the walls failed to reveal any evidence of echinococcus.

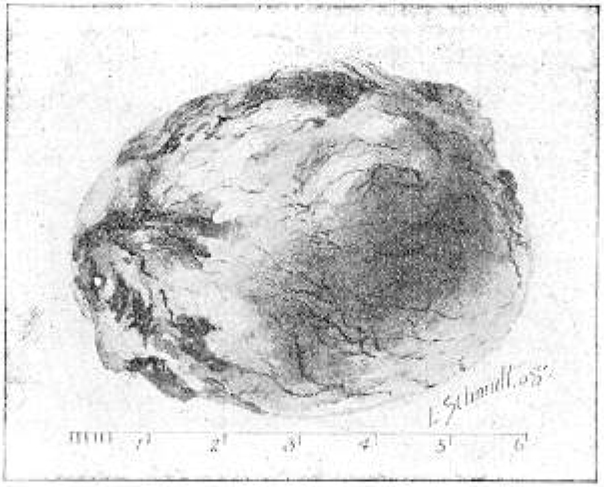

FIG. 6. Cyst, drawn to scale.

Microscopic examination of portions of the wall and of the tissue adherent to its inner wall failed to show any trace of brain tissue, or resemblance to any glioma or other tumor tissue. The wall was composed of several layers of fibrous tissue fairly rich in nuclei, and having an abundant blood supply; the inner surface was rough and ragged, while the outer layers seemed to have condensed to form the smooth outer surface. The tissue masses represented blood clot with fibrin, red cells, and pigment, and a few round cells, probably lymphocytes.

As to the pathological diagnosis there seemed to be little question from the macroscopic and microscopic features that we were dealing with a simple serous cyst. Cysts resulting from hemorrhage and softening are much more irregular in shape and have not a well developed sac. There was not the least suspicion that we were dealing with a cyst as part of the development of a morbid growth, such as sarcoma or glioma.

ANESTHESIA AND BLOOD PRESSURE RECORD.

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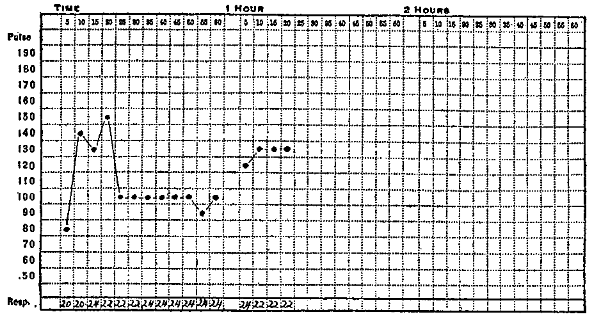
ANESTHESIA CHART.



Operation Cranıotomy
Date Feb 5th 1908
Operator Dr Frazier
Operation Started 1.24 P.M.
Operation Ended 2 43 P.M
Anesthetic Gas & Ether
Variety Squibbs
Method Gauze
Anesthetizer Dr van Naathoven
Time to Anesthetize 8 minutes
Amt. to Anesthetize ℥iss
Total Amt. Used ℥viiiss
Examination of Chest (before) Negative

BLOOD PRESSURE CHART

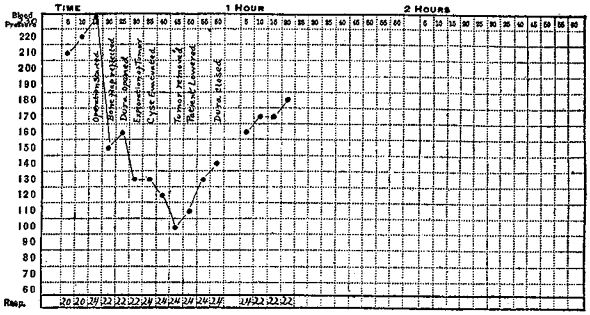


FIG. 7. Blood pressure chart, showing fall in blood pressure after removal of cyst.

The wall of the cyst throughout was composed of fibrous, not of tumor, tissue.

A word or two might be said as to the blood pressure (Fig. 7). Before the operation began the blood pressure registered

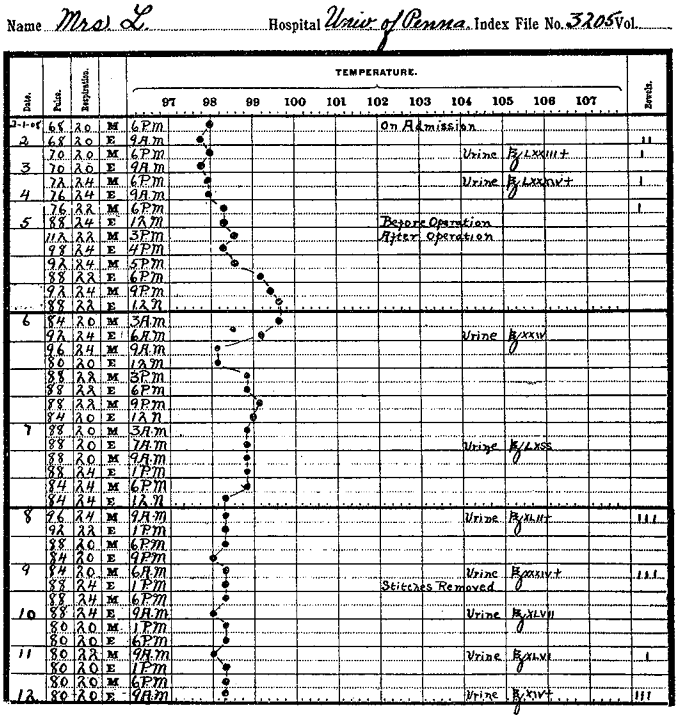
210 mm. of Hg; as soon as the flap was reflected, within five minutes, it dropped to 150, while the cyst was being removed to 100, and at the conclusion of the operation registered 180. Whether the high pressure at the beginning was due to a general arteriosclerosis or to increased intracranial tension is a matter of conjecture. On two occasions during the convalescent period the systolic pressure was 180 and 140 respectively. We are rather disposed to believe that in this case the intracranial tension was an influential factor, although in numerous and repeated observations in other cases of brain tumor or internal hydrocephalus the blood pressure has not been appreciably disturbed. When the pressure had fallen from 210 to 100 mm. of Hg during the course of the operation the position of the patient was changed from the vertical to the horizontal posture. This we have found almost invariably has a favorable influence upon the circulation and in this case the pressure at once began to rise until at the conclusion of the operation it registered 180. With the opportunity to observe the pressure throughout the operation we have no hesitation in placing the patient in the vertical posture. Apart from the fact that this position is more convenient for the operator it is very efficient as a means of controlling hemorrhage.

The recovery of the patient from the effects of the operation was prompt; during the convalescence the temperature did not rise above 99.4° F., nor the pulse above 96 (Fig. 8). The patient was sitting up in bed on the third and walking about her room on the fourth day, and with the removal of the stitches on the fifth day was concluded a brief but interesting surgical experience.

While the rapidity with which the signs of disturbed function disappeared constitutes one of the most striking features of the case, the absence of any immediate aggravation of symptoms was equally noteworthy. In many instances the trauma to the brain tissue, incidental to the removal of a growth, causes a transitory disturbance of function in the structure adjacent to the lesion. This is more particularly the case when the tumor is situated in the motor cortex. In a case recently operated upon, following the removal of a tumor the size of a hickory nut from the motor region, even though the growth was sharply defined and easily enucleated, the patient had a complete hemiplegia.

From the standpoint of the surgeon this case was of especial interest because it presented a benign, accessible and operable lesion. Perhaps the most discouraging feature of the surgery of brain tumors is the comparative infrequency of operable tumors. According to Duret's frequently quoted statistics, based on a series of 344 cases, but 10 per cent. were said to be operable and of these in two thirds the seat of the tumor was not determined; thus reducing the percentage of operable cases to 6.5 per cent. Many of the statistical tables, however, are based upon necropsy findings, when the tumor is far enough advanced to take the patient's life. This "autopsy method" of determining the operability of tumors, as we have had occasion to say before, is open to serious objection, and while the percentage of tumors suitable for radical operation will always be a small fraction of the whole, the reckoning should be made from the statistics of the surgical clinic and not of the pathological laboratory. In the clinic of the Hospital of the University of Pennsylvania we have had all told, nine cases of operable tumors; six of

TEMPERATURE RECORD.



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Date.	Pulse.	Respiration.			Temperature	Bowels.
2-1-08	68	20	M	6Pm	On Admission	
2	68	20	E	9Am		11
	70	20	M	6Pm	Urine ℥LXXIII+	1
3	70	20	E	9Am		
	72	24	M	6Pm	Urine ℥LXXXV+	1
4	76	24	E	9Am		
	76	22	M	6Pm		1
5	88	24	E	12M	Before Operation	
	112	22	M	3Pm	After Operation	
	98	24	E	4Pm		
	92	24	M	5Pm		
	88	22	E	6Pm		
	92	24	M	9Pm		
	88	22	E	12N		
6	84	20	M	3Am		
	92	24	E	6Am	Urine ℥XXIV	
	96	24	M	9Am		
	80	20	E	12M		
	88	22	M	3Pm		
	88	22	E	6Pm		
	88	22	M	9Pm		
	84	20	E	12N		
7	88	20	M	3Am		
	88	20	E	7Am	Urine ℥LXSS	
	88	20	M	9Am		
	88	24	E	1Pm		
	84	24	M	6Pm		
	84	24	E	12N		
8	96	24	M	9Am	Urine ℥XLIII+	111
	92	22	E	1Pm		
	88	20	M	6Pm		
	84	20	E	9Pm		
9	84	20	M	6Am	Urine ℥XXXIV+	111
	88	24	E	1Pm	Stitches Removed	
	88	24	M	6Pm		
10	88	24	E	9Am	Urine ℥XLVII	
	80	20	M	1Pm		
	80	20	E	6Pm		
11	80	22	M	9Am	Urine ℥XLVI	1
	80	20	E	1Pm		
	80	20	M	6Pm		
12	80	20	E	9Am	Urine ℥XIV+	111

FIG. 8. Temperature chart, showing how slight the effects of the operation were.

the cerebrum and three of the cerebellum. These represent approximately 20 per cent. of our series of tumor cases. While the decompressive operation is wonderfully effective in palliating symptoms and prolonging life, and some of the results of the radical procedure appear discouraging, no case should be branded inoperable until so proved by a thorough exploration through a liberal opening. Only by early diagnoses and by a resort without procrastination to well-executed craniotomies, even though there may be some doubt as to the precise location of the tumor, can we determine whether or not we are justified in relapsing into that state of pessimism which characterized the attitude of the profession not many years ago.

Examinations of the patient were made with the view of determining the effects of the operation and removal of the cyst upon her nervous system from time to time during her stay at the hospital. On February 8, three days after the operation, a note was made that the ataxia was fast disappearing and that the patient's mental condition, although never dull to the extent of being seriously affected, was becoming much brighter. On February 12 the record was made that all functions of the arm and leg were restored. The ataxia had disappeared. Testing for astereognosis, the sense of location and position, and cutaneous sensibility the results were negative. Motor functions were normal in both arms. The patient seemed to have a little less voluntary control of the left side of the face, but she stated that this had always been the case. Hemianopsia was much less marked as was shown by various tests. On the fifteenth the affected limbs appeared to be entirely normal, and the patient evidently saw much better. She was able at this time to detect much smaller objects about her room.

The examinations of Dr. de Schweinitz, already detailed, give more explicitly the facts as to her eyes and vision.

The completeness of the removal in this case of a large parieto-occipital cyst, and the entire disappearance of the severe and threatening symptoms produced by it, entitle it to be regarded as one not merely of palliation but of cure. Apparently the cyst was benignant in character. We have seen the patient within two weeks of the presentation of this report. In every particular she was in excellent health, being with the exception of the very partial hemianopsia, free from signs of cerebral disease.

From the standpoint of physiology, especially as regards the functions of the parietal lobe and the possibility, in considering lesions of this lobe, of subdividing it functionally into several parts, the case also is of much interest.

We have had the opportunity of studying at least four classes of cases, giving different symptom complexes, according to the degree of implication of the various portions of the parietal lobe. Possibly in time more than this number of syndromes can be separated for diagnostic purposes. These symptom complexes are: (1) Pronounced hemianopsia and ataxia, combined with pressure symptoms varying in intensity, such as hypesthesia, hypastereognosis, and slight paresis of the face and limbs; (2) astereognosis and ataxia, combined with symptoms showing various degrees of involvement of cutaneous, muscular, and arthroidal sensibility, but without hemianopsia and with no or only slight paresis; (3) hemianopsia and hemiataxia, with hypesthesia and hypastereognosis and pronounced paresis, especially of the face and upper extremity; and (4) astereognosis and ataxia, with hypesthesia and pronounced paralysis, especially in the lower and upper extremities. These symptom complexes, more or less pure at first, become complicated as the tumor or cyst increases, and with it the variety and extent of the symptomatology. From cases already recorded, illustration of each of these symptom groups might be given.

In considering the question of the position and extent of an opening for the removal of a tumor or cyst, the osteoplastic flap should be planned somewhat differently in accordance with these symptom complexes. For the first, in which pronounced hemianopsia and hemiataxia are the dominating symptoms, the incision for an opening three and a half or four inches in length for its superior boundary should be made, about one inch from the mesal edge of the hemisphere and in such manner that about one half of it should be cephalad and the other caudad, of the line of the parieto-occipital fissure. The base line connected by the somewhat converging sides of the opening should be over the upper part of the temporal lobe. With the second symptom complex in view—that in which astereognosis and ataxia, without hemianopsia, are the chief guiding symptoms—the opening should be carried as close as possible to the middle line of the skull, and should be an inch more anterior. The incision for the upper line of the third opening, for a case giving the syndrome in which hemiataxia, sometimes with hemianopsia and also with hypesthesia, impairment of the muscular sense and hemiparesis or hemiparalysis, especially in the face, are present, should extend about one third in front and two thirds behind the central fissure, and about one inch or one and one half inches from the median line, the base, as in the first opening, being over the temporal lobe. The incision for the upper limit of the fourth opening should be as near as possible to the mid-line of the skull, while its sides should be in about the same relative positions to the central fissure, that is so as to uncover the cerebral surface about one third in front and two thirds behind this fissure. By having the lines of the opening in the manner here indicated, the surgeon will probably find the main portion of the growth near the center of the field of operation.